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Capturing Structured, Pulmonary Disease-Specific Data Elements in Electronic Health Records

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Electronic health records (EHRs) have the potential to improve health-care quality by allowing providers to make better decisions at the point of care based on electronically aggregated data and by facilitating clinical research. These goals are easier to achieve when key, disease-specific clinical information is documented as structured data elements (SDEs) that computers can understand and process, rather than as free-text/natural-language narrative. This article reviews the benefits of capturing disease-specific SDEs. It highlights several design and implementation considerations, including the impact on efficiency and expressivity of clinical documentation and the importance of adhering to data standards when available. Pulmonary disease-specific examples of collection instruments are provided from two commonly used commercial EHRs. Future developments that can leverage SDEs to improve clinical quality and research are discussed.   CHEST 2015; 147(4):1152-1160

ABBREVIATIONS: CDS = computerized decision support; EHR = electronic health record; SDE = structured data element

The promise of electronic health records (EHRs) to improve health-care quality rests largely on their ability to help physicians and researchers make more effective use of information.[1] Simply digitizing clinical records provides some quality benefits through improved legibility and availability of information; however, its impact tends to be self-limited.[1,2] A growing body of evidence suggests that a major key to realizing quality improvement is computerized decision support (CDS), a term encompassing a broad variety of tools designed to help providers make better decisions at the point of care.[3-7]

Clinical research may also benefit from the ability to mine EHR data to test hypotheses more efficiently than can be done through prospective clinical trials.[8,9] Many experts believe that together, advanced CDS and secondary use of EHR data for clinical research have the potential to create a "learning health system" that can truly transform health-care quality.[10-15]

A challenge to this vision is that CDS and secondary use of EHR data are only possible to the extent that computers can interpret and "reason" about the information that EHRs contain. To be "machine interpretable,"

information must be structured into sets of facts or assertions to which computer logic can be applied. Availability of such "structured data elements" (SDEs) is, therefore, one of the major keys to using EHRs to improve quality. When we are able to efficiently capture as a byproduct of clinical care and effectively use a wealth of SDEs relevant to the understanding and management of specific diseases, we will begin to unlock the true potential of EHR technology.

Capturing SDEs efficiently and using them effectively are not without challenges.[16-21] This article reviews important factors to consider in their design and implementation. We present several pulmonary-specific examples that have been developed and incorporated into clinical workflows in two commonly used EHR systems: Epic (Epic Systems, Inc) and Centricity (GE Healthcare). Finally, we review developments in both CDS and the secondary use of EHR data that are likely to have an increasing impact on clinical care and research in the next 3 to 5 years.

Design and Implementation Considerations

Efficiency and Expressivity of Documentation

Its impact on the efficiency of the office visit is widely recognized as an obstacle to the adoption of EHR technology. Evidence suggests that EHRs increase the amount of time physicians spend on documentation.[22,23] Many providers feel that SDE capture further decreases efficiency because it may require more clicks or result in double data entry if the same information needs to be recorded separately in structured fields and in a typed or dictated note.

Although development has been somewhat slow, strides have been made to address this problem. As a result of the federal Meaningful Use incentive program, all certified EHRs now have the ability to capture as SDEs key components of the history and physical examination, such as the problem list, allergies, medications, and family and social history.[24] Many EHRs also now have the ability, using macros, to pull these SDEs into a consult or progress note automatically.[25] A number of EHRs also provide the ability to document narrative aspects of the encounter, such as the history of the current illness, review of systems, physical examination, and assessment and plan, via structured forms that automatically generate prose text for the note.

Figure 1 illustrates an Epic-provided template for documenting the history of present illness for a chief complaint of asthma, along with the progress note text that is autogenerated based on the selections seen. Figure 2 illustrates a similar asthma template custom developed for Centricity by Clinical Content Consultants, LLC. As the design of user interfaces and text generation engines in commercial EHRs become more sophisticated, the usability of such tools should continue to improve.

These technical advances can help increase the efficiency of structured documentation, but workflow is also a key factor. Practices that have made the transition to an EHR understand that processes from the paper chart era need to change to make the most of EHR capabilities.[26-28] Sharing the documentation burden across members of the care team is critical to optimizing efficiency, as long as the providers are careful to act within the scope of their licenses and federal and state regulations.

Although there may be an upfront cost to entering data discretely the first time, updating it and automatically including or referencing it in subsequent documentation is typically a more efficient process. Some practices have introduced telephone-based EHR "intake" visits for patients new to their practice, so important demographic and clinical SDEs can be entered into the system by a physician-extender before a face-to-face encounter with the primary provider. These kinds of workflow changes allow practices to better leverage SDEs to improve the overall efficiency of the primary provider and the clinic flow.

Expressivity sits in natural tension with increased structure in clinical documentation.[16] Patients' descriptions of their history and providers' descriptions of their impressions and thought processes tend to include substantial nuance and subtlety. By definition, SDEs force at least some reduction in the flexibility, variability, and expressive richness of a natural language narrative. They can even lead to inaccuracy when precise codes are applied inappropriately for situations that the structured template cannot accommodate adequately.[16,21]

A balance between structure and expressivity may be achieved by being selective about which information to capture discretely. Although it is possible to cover almost all aspects of a note with SDEs, beyond a certain point, doing so provides diminishing returns for the incremental burden and rigidity that it imposes. For better efficiency and effectiveness, discrete data capture can be limited to the elements that have the greatest impact on clinical decision-making. Often, these are represented by the decision nodes in expert clinical guidelines.